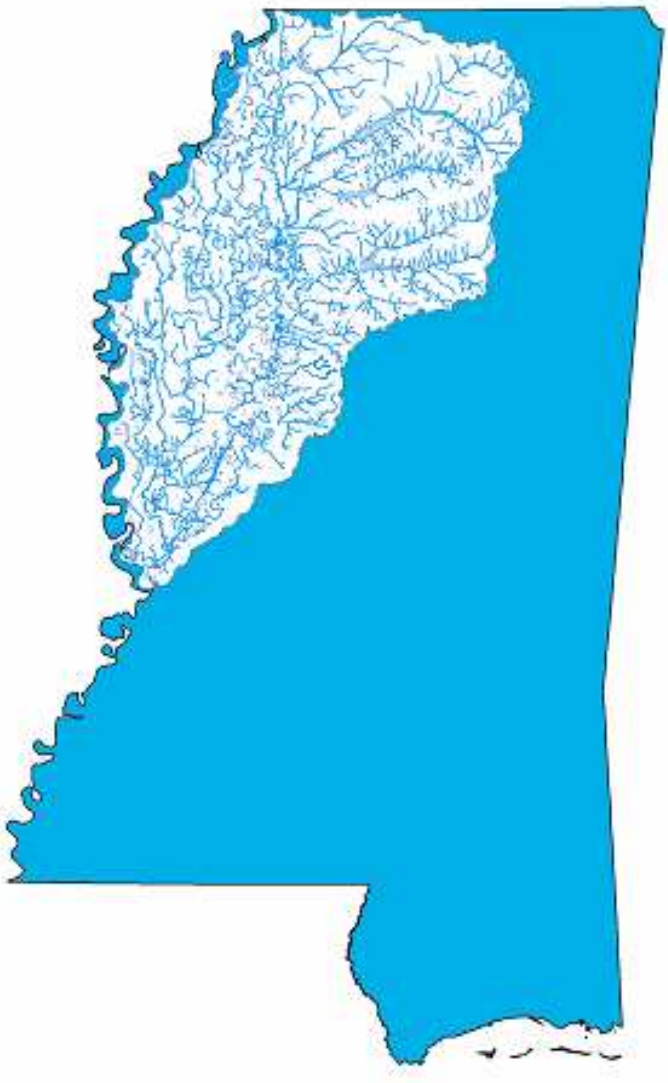
FINAL REPORT
November 2005
ID: 905110401

Total Maximum Daily Loads For The Legacy Pesticides, DDT and Toxaphene, In The Yazoo River Basin

Prepared by
Mississippi Department of Environmental Quality
Office of Pollution Control



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Foreword

This report has been prepared in accordance with the schedule contained within the federal consent decree dated December 22, 1998. The report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's 1996 Section 303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Prefixes for fractions and multiples of SI units

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^{2}	hecto	h
10^{-3}	milli	m	10^{3}	kilo	k
10^{-6}	micro	µ	10^{6}	mega	M
10^{-9}	nano	n	10^{9}	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
Acres	Sq. miles	0.00156	Days	Seconds	86400
Cubic feet	Cu. Meter	0.0283	Feet	Meters	0.3048
Cubic feet	Gallons	7.48	Gallons	Cu feet	0.1337
Cubic feet	Liters	28.3	Hectares	Acres	2.471
cfs	Gal/min	448.8	Miles	Meters	1609.3
cfs	MGD	.6463	Mg/l	ppm	1
Cubic meters	Gallons	264.2	µg/l * cfs	Gm/day	2.45

Table of Contents

Original Listing

Mississippi conducted a survey of district conservationists (DC) in 1988 and 1989 to find candidate watersheds for future §319 funding opportunities. MDEQ requested each DC identify the watersheds of concern in their county based on available information including land use. Numerous DCs responded to the survey and MDEQ created Mississippi's §319 list based on these surveys.

In 1992, MDEQ compiled a §303(d) list based, in part, on the §319 list of watersheds of concern. Therefore, water bodies were included on the §303(d) list based on speculation and not water quality monitoring. MDEQ uses the term, evaluated, to describe these water bodies that were placed on the §303(d) list without monitoring data. At the time, MDEQ considered the evaluated listings from the §319 survey as a placeholder for future monitoring to determine if there were indeed impairment in the watershed.

The surveys asked for the presence of agriculture, urban areas, or forestry in the watershed. MDEQ interpreted potential pollutants present on these land uses and listed several broad potential pollutant categories based on the survey results. Every watershed, for which agriculture was checked, was then listed for sediment, pesticides, organic enrichment/low dissolved oxygen, and nutrients.

Current Use Pesticides

Since the late 1980s and early 1990s, pesticide use, composition, and delivery technology have changed considerably. Current use pesticides are more biodegradable and not as persistent in the environment as the legacy pesticides DDT and Toxaphene. The improved chemical composition makes current use pesticides more expensive. Therefore, delivery technology has also been improved to reduce overspray.

This TMDL is for DDT and Toxaphene, which have been found in fish flesh samples, and it represents the pesticide listings in the 1996 and 1998 Mississippi §303(d) List. The original listings were not specific, however the listings were meant to represent pesticides for which Mississippi waters have impairment. The fish consumption advisory issued for the Mississippi Delta is due to elevated levels of DDT and Toxaphene. Therefore, the current use pesticides are not included in the pesticide listings. If current use pesticides were found impairing a water body segment, that segment would be listed on the next §303(d) list with the specific chemical pollutant identified.

Pollutant Source

In the 1950s and 1960s agricultural producers used pesticides that were chemically and environmentally different from the current use pesticides. DDT and Toxaphene have decades long half-lives as opposed to the days or weeks long half-lives of current use

pesticides. One reason for the drastically reduced half-lives of current use pesticides is that today's competitive pesticide market is encouraging production of more "natural" and "environmentally friendly" pesticides. In essence, environmental effects of legacy pesticides are much different from those of current use pesticides and require different evaluations. Even after 25 years of little or no use, DDT metabolites are still being found in the environment. DDT contamination has been shown to weaken egg shells of certain avian species, such as eagles and pelicans, which can severely impact reproduction rates.

The use of DDT was prohibited in the United States in 1973, and Toxaphene was banned in 1982. Production of both has ceased in the United States. Unfortunately, degraded metabolites of the parent compound are still present in the Yazoo River Basin. Elevated levels have been found in several fish species, and sediment tests show that the legacy pesticides are still present in the fields and streams. Due to concern about the carcinogenic impact of these pollutants, MDEQ issued a basin-wide fish consumption advisory for 4 species of fish. The good news is that the pesticide levels found in fish are going down. The purpose of this TMDL document is to promote further reduction of the levels found in the aquatic species by promoting best management practices that keep the sediment (and the pesticides) on the fields and out of the streams.

Identification of Water Bodies

This TMDL has been developed to meet the requirements of the federal consent decree between EPA Region 4 and the Mississippi Sierra Club. The consent decree is based on the 1996 §303(d) list. In that list, water bodies were listed as either monitored (M) or evaluated (E).

EPA agreed to complete the TMDLs for all water bodies identified as monitored during the first five-year rotation of Mississippi's basin rotation plan, and for all water bodies identified as evaluated during the second five-year rotation. This agreement was made without regard to the status of water quality data for the specific pollutant listed for the water body. In the Yazoo River Basin there was no specific pesticide data available that would support a listing for a specific pesticide for either monitored or evaluated listings. However, there were several fish samples that indicated the need for a fish consumption advisory for DDT and Toxaphene contamination. Therefore, MDEQ completed the TMDL for the monitored water bodies in 2003.

MDEQ is preparing this TMDL for the evaluated pesticide listings in the Yazoo River Basin from the 1996 Mississippi 303(d) list. Table 1 lists the water body name, identification number, and location information for each water body included in this TMDL Report. The maps following the table show the locations of the evaluated water body segments. The monitored DDT and Toxaphene listings from the 2004 §303(d) list are also included. There are 91 evaluated listings and 11 monitored listings included.

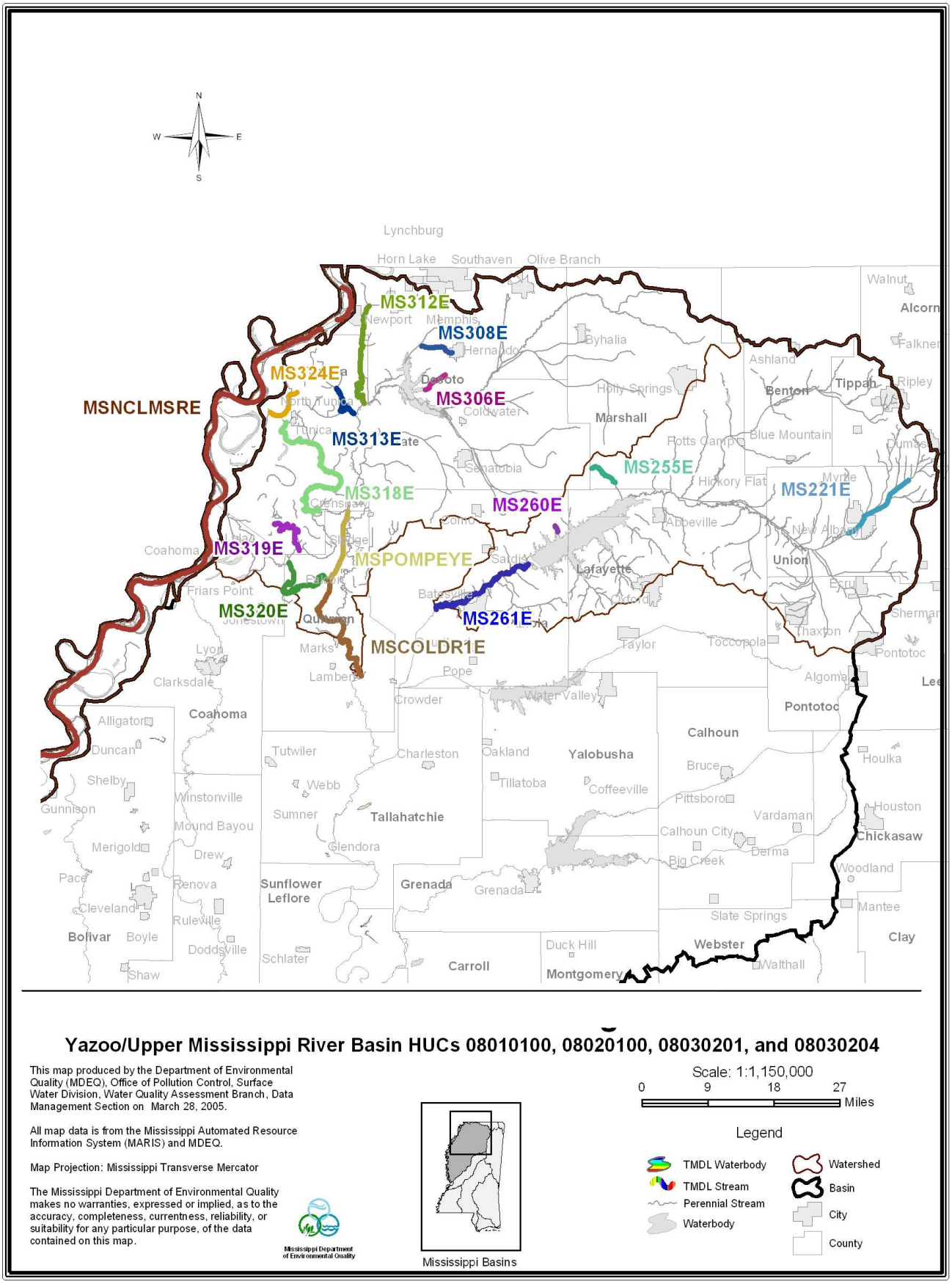
Table 1. Water Body Locations

Water Body Name	Water Body ID	Water Body Location
ABIACA CREEK	MS357E	NEAR OKLAHOMA FROM HEADWATERS TO WATERSHED 355 BOUNDARY
ARK BAYOU	MS319E	NEAR LULA FROM HEADWATERS TO THE COLDWATER RIVER
ASCALMORE CREEK	MS348E	NEAR PAYNES FROM ASCALMORE CANAL TO CONFLUENCE WITH TIPPO BAYOU
BEAR CREEK	MS354E	MULTIPLE SEGMENTS BETWEEN THREE MILE AND SIX MILE LAKES AND BETWEEN BLUE AND THREE MILE LAKES
BEAVER DAM BAYOU	MS381E	AT INDIANOLA FROM HEADWATERS TO THE BIG SUNFLOWER RIVER
BIG SAND CREEK	MS352BE	NEAR BRIGHT CORNER FROM WATERSHED 353 BOUNDARY TO THE YALOBUSHA RIVER THROUGH BIG SAND CREEK CUTOFF
BIG SUNFLOWER RIVER	MSBIGSUNRE	FROM HEADWATERS AT CONFLUENCE WITH WHITTAKER BAYOU TO THE YAZOO RIVER
BIG SUNFLOWER RIVER DIVERSION CHANNEL	MSBGSND1E	FROM HUC BOUNDARY 08030208 TO CONFLUENCE WITH STEELE BAYOU
BIG SUNFLOWER RIVER DIVERSION CHANNEL	MSBGSND2E	FROM HUC BOUNDARY 08030207 TO HUC BOUNDARY 08030209
BLACK BAYOU	MS376E	NEAR LOMBARDY FROM HEADWATERS TO THE BIG SUNFLOWER RIVER
BLACK BAYOU	MS403E	NEAR REFUGE
BLACK LAKE BAYOU	MS371BLE	NEAR JONESTOWN FROM HEADWATERS TO CONFLUENCE WITH LAKE BAYOU
BLACKWATER CREEK	MS255E	NEAR BLACKWATER FROM HEADWATERS TO SARDIS LAKE FLOOD POOL
BO-BO BAYOU	MS266E	NEAR CURTIS STATION FROM HEADWATERS TO CONFLUENCE WITH ASH LOG BAYOU
BOGUE PHALIA	MS388E	NEAR NAPANEE FROM HEADWATERS TO CONFLUENCE WITH CLEAR CREEK
BOGUE PHALIA	MS392E	NEAR DARLOVE FROM CLEAR CREEK TO THE BIG SUNFLOWER RIVER
BUCK ISLAND BAYOU	MS313E	NEAR PRICHARD FROM CONFLUENCE WITH FLOYD BAYOU TO THE COLDWATER RIVER
BURRELL BAYOU	MS378E	NEAR DOCKERY FROM HEADWATERS TO THE BIG SUNFLOWER RIVER
CANE CREEK	MS306E	NEAR PLEASANT HILL FROM HEADWATERS TO ARKABUTLA LAKE FLOOD POOL
CASSIDY BAYOU	MS275E	NEAR TUTWILLER FROM WATERSHED 274 BOUNDARY TO WATERSHED 277 BOUNDARY
CASSIDY BAYOU	MS277E	AT WEBB FROM WATERSHED 275 BOUNDARY TO THE TALLAHATCHIE RIVER (2004 DDT)
CLEAR CREEK	MS389E	NEAR LEES FLAT FROM HEADWATERS EXCLUDING SHELL LAKE TO CONFLUENCE WITH BOGUE PHALIA
COLDWATER RIVER	MS320E	NEAR MARKS FROM CONFLUENCE WITH YAZOO PASS TO POMPEY DITCH
COLDWATER RIVER	MSCOLDR1E	AT COLDWATER RIVER FROM CONFLUENCE WITH POMPEY DITCH TO CONFLUENCE WITH OLD LITTLE TALLAHATCHIE

Water Body Name	Water Body ID	Water Body Location
COLLINS CREEK	MS397E	NEAR ELDARADO FROM HEADWATERS TO THE YAZOO RIVER
CYPRESS CREEK	MS337E	NEAR COFFEEVILLE FROM HEADWATERS TO GRENADA LAKE FLOOD POOL
CYPRESS LAKE	MS407CLE	OXBOW LAKE NEAR VALLEY PARK
DEER CREEK	MS402E	NEAR WINTERVILLE FROM LAKE BOLIVAR TO DEER CREEK
DEER CREEK	MS407M1	FROM SMEDES TO VALLEY PARK
DEER CREEK	MS403M6	FROM ARCOLA TO PERCY (2004 DDT and Toxaphene)
EAST LEVEE CREEK	MS270E	ADJACENT TO PANOLA QUITMAN FLOODWAY FROM ROBINSON BAYOU TO CONFLUENCE WITH TALLAHATCHIE RIVER
EDEN CREEK	MS365E	NEAR ZELLERIA FROM HEADWATERS TO THE YAZOO RIVER
FALSE RIVER	MS396E	NEAR SMEDES FROM HEADWATERS TO THE LITTLE SUNFLOWER RIVER
FOUR MILE LAKE	MS354FLE	OXBOW LAKE FROM BEAR CREEK (MS354M1) TO BEAR CREEK (MS354M2)
GRASSY LAKE	MS270GLE	NEAR TIPPO
HARRIS BAYOU	MS373E	NEAR BEVERLY FROM HEADWATERS AT RICHIES BAYOU TO THE BIG SUNFLOWER RIVER INCLUDING FORK TO HOWDEN LAKE
HOME CYPRESS BAYOU	MS384E	NEAR ROME FROM HEADWATERS TO THE QUIVER RIVER
HOPSON BAYOU	MS276E	AT TUTWILLER FROM HEADWATERS TO CASSIDY BAYOU
HOWDEN LAKE	MS373HLE	OXBOW LAKE NEAR ALIGATOR TO HARRIS BAYOU
HUSHPUCKENA RIVER	MS375E	NEAR ALIGATOR FROM HEADWATERS TO THE BIG SUNFLOWER RIVER
INDIAN BAYOU	MS406E	NEAR FITLER FROM HEADWATERS TO WATERSHED 405 BOUNDARY
JAYNES BAYOU	MS393E	NEAR ROLLING FORK FROM HEADWATERS TO THE BIG SUNFLOWER RIVER
JONES BAYOU	MS379E	NEAR ROUNDAWAY FROM WATERSHED 377 BOUNDARY TO THE BIG SUNFLOWER RIVER
LAKE BAYOU	MS371E	NEAR CLOVER HILL FROM CONFLUENCE WITH BLACK LAKE BAYOU TO THE BIG SUNFLOWER RIVER
LAKE BOLIVAR	MS402LBE	OXBOW LAKE NEAR SCOTT
LAKE CORMORANT BAYOU	MS312E	NEAR PRICHARD FROM JOHNSON CREEK TO THE COLDWATER RIVER
LAKE GEORGE	MS395LGE	AT HOLLY BLUFF FROM THE LOWER AUXILLARY CHANNEL TO THE YAZOO RIVER
LAKE HENRY	MS385LHE	NEAR ITTA BENA
LAKE JACKSON	MS404LJE	OXBOW LAKE NEAR GLEN ALLEN
LITTLE SUNFLOWER RIVER	MS371E1	AT CLARKSDALE FROM CONFLUENCE WITH SANDY BRANCH TO THE BIG SUNFLOWER RIVER
LITTLE TALLAHATCHIE RIVER	MS221E	NEAR MARTINTOWN FROM WATERSHED 220 BOUNDARY TO CONFLUENCE WITH KING CREEK
LITTLE TALLAHATCHIE RIVER	MS261E	NEAR SARDIS FROM LOWER SARDIS LAKE TO CONFLUENCE WITH MCIVER CANAL
LOWER AUXILLARY CHANNEL	MSLOWAUXE	NEAR SILVER CITY FROM CONFLUENCE WITH YAZOO RIVER TO CONFLUENCE WITH BIG SUNFLOWER RIVER
MACON LAKE	MS354ML2E	OXBOW LAKE NEAR INVERNESS

Water Body Name	Water Body ID	Water Body Location
MCINTYRE LAKE	MS350MLE	NEAR MONEY
MCKINNEY BAYOU	MS324E	NEAR HOLLYWOOD FROM HEADWATERS TO TUNICA CUTOFF ABANDONED OXBOW
MISSISSIPPI RIVER	MSCLMSRE	AT CENTRAL LOWER MS RIVER: FROM LAKE BEULAH-HUC BOUNDARY TO VICKSBURG-HUC BOUNDARY
MISSISSIPPI RIVER	MSNCLMSRE	NORTH CENTRAL LOWER MISSISSIPPI RIVER: FROM HUC BOUNDARY UPSTREAM TO LAKE BEULAH - HUC BOUNDARY
MOSSY LAKE	MS354ML1E	OXBOW LAKE NEAR MORGAN CITY
MOUND BAYOU	MS377E	NEAR MERIGOLD FROM CONFLUENCE WITH LITTLE MOUND BAYOU TO THE BIG SUNFLOWER RIVER
NELSON CREEK	MS260E	NEAR HAYES CROSSING FROM HEADWATERS TO SARDIS LAKE FLOOD POOL
OPPOSUM BAYOU	MS269E	NEAR LAMBERT FROM HEADWATERS TO THE TALLAHATCHIE RIVER
OXBERRY BAYOU	MS343E	NEAR LEFLORE FROM HEADWATERS TO THE YALOBUSHA RIVER
PANOLA QUITMAN FLOODWAY	MSPQWAYE	FROM CONFLUENCE WITH MCIVOR CANAL TO CONFLUENCE WITH TALLAHATCHIE RIVER
PATTERSON BAYOU	MS345E	NEAR TIPPO FROM HEADWATERS TO SOUTHLAKE BAYOU
POMPEY DITCH	MSPOMPEYE	NEAR CRENSHAW FROM NORTH SPLIT WITH THE COLDWATER RIVER TO CONFLUENCE WITH THE COLDWATER RIVER NEAR DARLING
PORTER BAYOU	MS380E	NEAR INDIANOLA FROM HEADWATERS TO THE BIG SUNFLOWER RIVER
QUIVER RIVER	MS383E	NEAR ROME FROM HEADWATERS AT THE LOWER QUIVER RIVER TO WATERSHED 385 BOUNDARY
QUIVER RIVER	MS386M2	NEAR MOORHEAD FROM CONFLUENCE WITH MUDDY BAYOU TO CONFLUENCE WITH MOORHEAD BAYOU
RICHIES BAYOU	MS374E	NEAR SHERARD FROM HEADWATERS TO CONFLUENCE WITH HARRIS BAYOU
ROEBUCK LAKE	MS354RLE	OXBOW LAKE AT ITTA BENA (2004 DDT and Toxaphene)
SILVER CREEK	MS394E	NEAR HOLLY BLUFF FROM HEADWATERS TO THE BIG SUNFLOWER RIVER
SIX MILE LAKE	MS354SL1E	NEAR NICHOLS FROM BEAR CREEK (MS354E) TO BEAR CREEK (MS354M1)
SKY LAKE	MS354SL2E	OXBOW LAKE NEAR JAKE TOWN
SNAKE CREEK	MS358E	NEAR BELZONI FROM SNAKE CREEK BRAKE TO THE YAZOO RIVER
STEELE BAYOU	MS404E	NEAR ISSAQUENA FROM BLACK BAYOU TO THE YAZOO RIVER
STEELE BAYOU	MS407S	NEAR ONWARD FROM HIGHWAY 1 TO THE YAZOO RIVER (2004 DDT and Toxaphene)
STOVALL LAKE	MS371SLE	OXBOW LAKE NEAR STOVALL
TALLAHATCHIE RIVER	MSTALARE	FROM CONFLUENCE AT SOUTHEND OF PANOLA QUITMAN FLOODWAY TO CONFLUENCE WITH THE YALOBUSHA RIVER
TALLAHATCHIE RIVER	MSUTALARE	FROM CONFLUENCE OF COLDWATER RIVER & OLD LITTLE TALLAHATCHIE TO CONFLUENCE WITH SOUTHERN END OF PANOLA QUITMAN FLOODWAY
TCHULA LAKE	MS358TLE	AT TCHULA FROM HEADWATERS NEAR CRUGER TO THE YAZOO RIVER

Water Body Name	Water Body ID	Water Body Location
TEOC CREEK	MS352WE	NEAR TEOC FROM HEADWATERS TO THE YALOBUSHA RIVER
TIPPO BAYOU	MS346E	NEAR MEHR FROM HEADWATERS NEAR EFFIE TO HIGHWAY 8
UNNAMED TRIBUTARY TO HURRICANE CREEK	MS308E	NEAR HORNLAKE FROM HEADWATERS TO HURRICANE CREEK
UPPER SIX MILE LAKE	MS350USLE	NEAR MONEY
VANEY CREEK	MS349E	NEAR HUGO FROM HEADWATERS TO TIPPO BAYOU
WHITE OAK BAYOU	MS318E	NEAR TUNICA FROM HEADWATERS TO THE COLDWATER RIVER
WILLIS CREEK	MS367E	AT YAZOO CITY FROM HIGHWAY 49 TO THE YAZOO RIVER
WOLF LAKE AND BROAD LAKE	MS363WLM	OXBOW LAKE NEAR LAKE CITY (2004 DDT and Toxaphene)
YALOBUSHA RIVER	MS325YE	NEAR CALHOUN CITY FROM HEADWATERS AT CONFLUENCE WITH FOUR MILE CREEK TO CONFLUENCE WITH LICKUP CREEK
YALOBUSHA RIVER	MSYLBUSHE	FROM GRENADA RESERVOIR SPILLWAY TO GRENADA POTW OUTFALL
YAZOO RIVER	MSYAZR1E	FROM CONFLUENCE WITH THE BIG SUNFLOWER RIVER TO CONFLUENCE WITH THE MISSISSIPPI RIVER
YAZOO RIVER	MSYAZR2E	FROM CONFLUENCE AT NORTH END OF LOWER AUXILLARY CHANNEL TO CONFLUENCE WITH THE BIG SUNFLOWER RIVER
YAZOO RIVER	MSYAZR3E	FROM CONFLUENCE OF YALOBUSHA RIVER & TALLAHATCHIE RIVER TO CONFLUENCE WITH NORTH END OF THE LOWER AUXILLARY CHANNEL
YAZOO RIVER	MSYAZR3M1	NEAR SHELL BLUFF FROM CONFLUENCE OF TALLAHATCHIE & YALOBUSHA RIVERS TO BELZONI (2004 DDT and Toxaphene)
YOCONA RIVER	MS292E	NEAR CROWDER FROM ENID SPILLWAY TO PANOLA QUITMAN FLOODWAY



Yazoo/Upper Mississippi River Basin HUCs 08010100, 08020100, 08030201, and 08030204

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All map data is from the Mississippi Automated Resource Information System (MARIS) and MDEQ.

Map Projection: Mississippi Transverse Mercator

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Mississippi Department of Environmental Quality

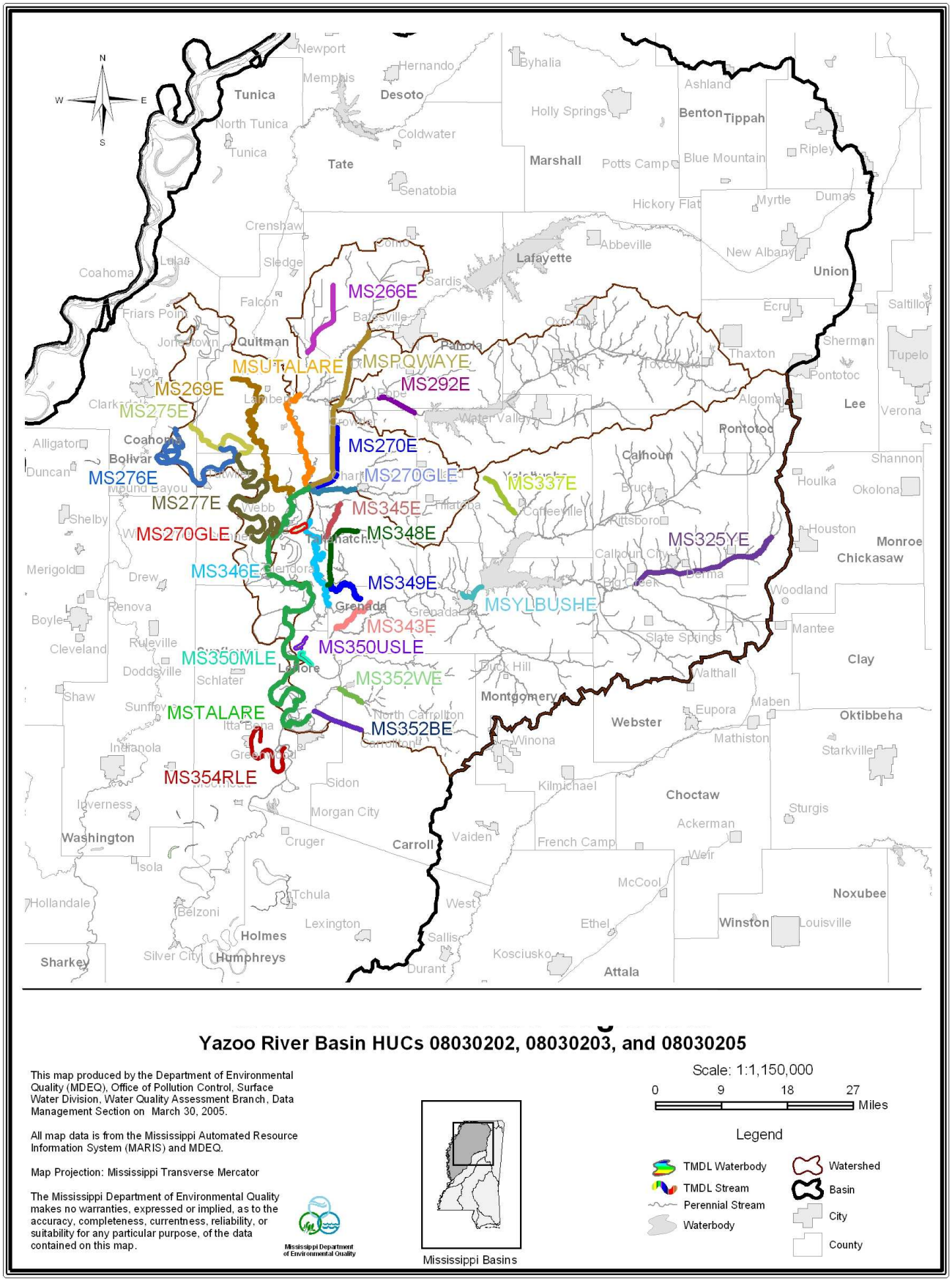
Mississippi Basins

Scale: 1:1,150,000

0 9 18 27 Miles

Legend

- TMDL Waterbody
- TMDL Stream
- Perennial Stream
- Waterbody
- Watershed
- Basin
- City
- County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Montgomery
Grenada
Leflore
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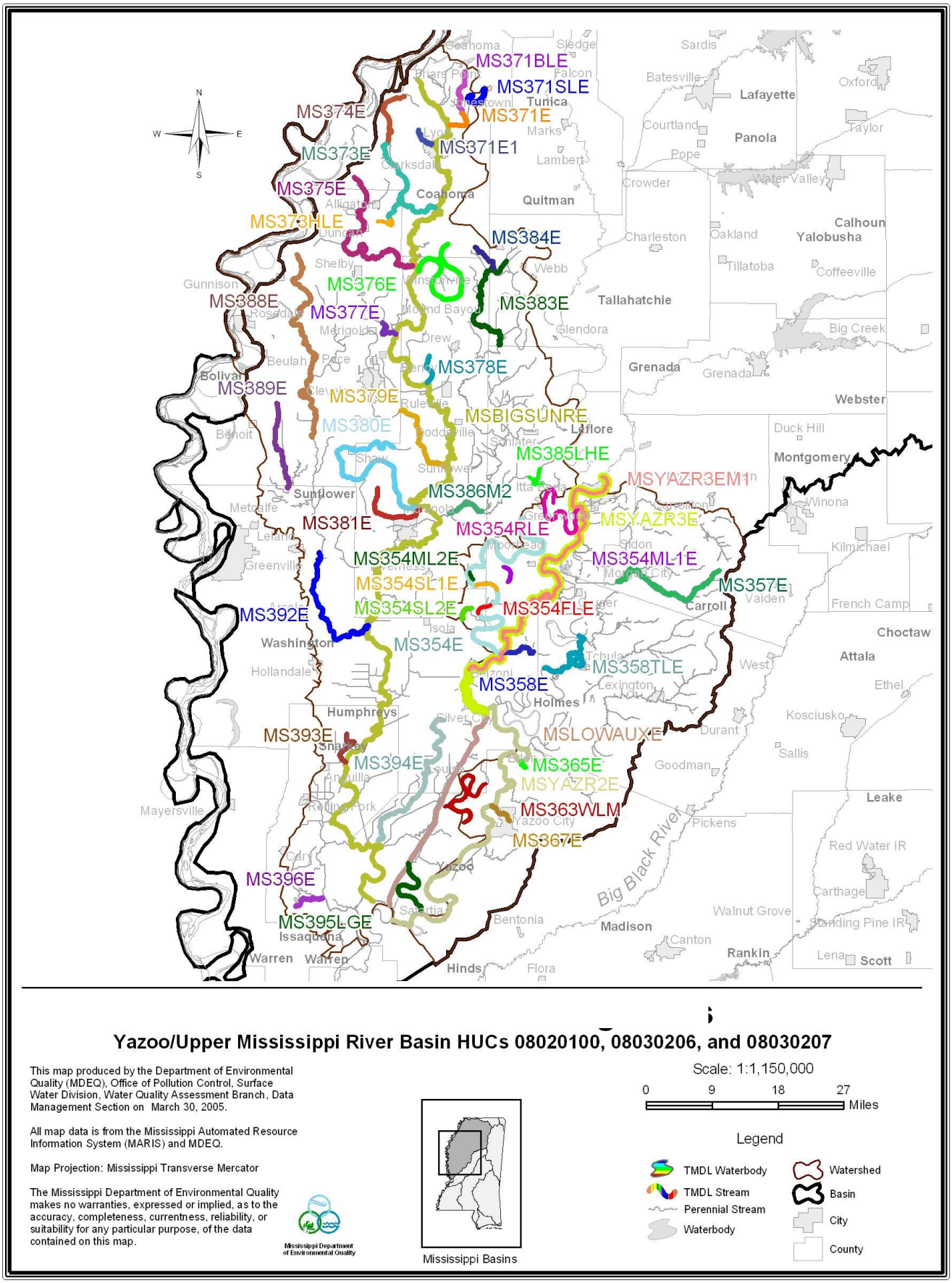
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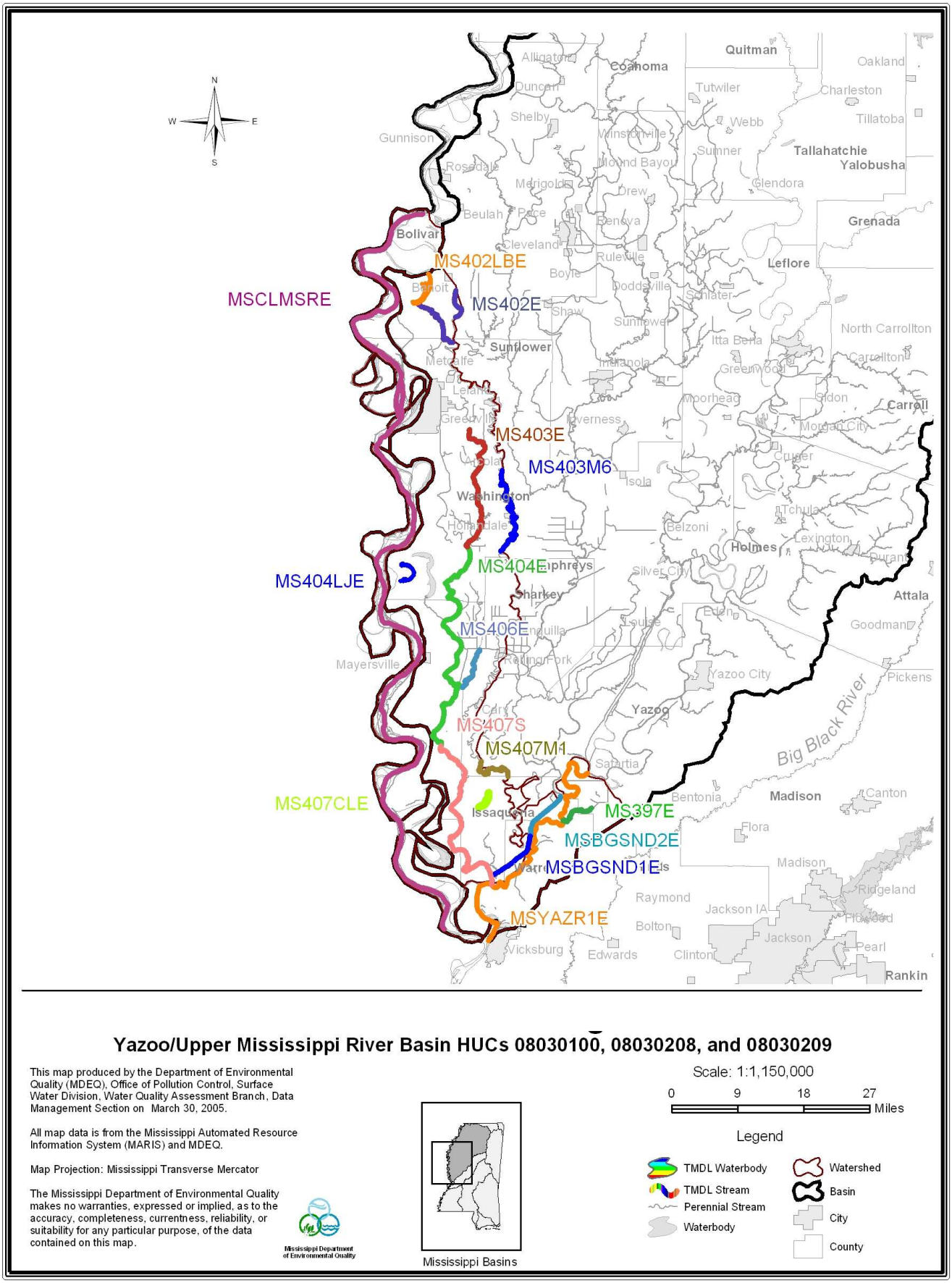
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Pollutant of Concern

Since 1969 the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) has studied the levels of DDT and Toxaphene in fish from Delta lakes. Muscle tissue concentrations of DDT up to 29 mg/kg led to advisories on Wolf Lake, Mossy Lake, and Lake Washington in the late 1960s and early 1970s. MDWFP continued annual monitoring of these lakes, and the advisories were rescinded when the average levels fell below the Food and Drug Administration Action Levels. The advisories were removed from Washington and Mossy Lakes in 1976 and from Wolf Lake in 1982 (MDEQ, 2001).

MDEQ began sampling whole fish from the rivers and streams in the Delta in 1979. This monitoring found similar levels of DDT and Toxaphene in the rivers as MDWFP had found in the lakes, which showed a declining trend in the pesticide concentrations from the 1960s. In 1984 the U.S. Fish and Wildlife Service (USFWS) in its National Contaminant Biomonitoring Report found concentrations of DDT in whole carp from the Yazoo River at Redwood, Mississippi to be the highest of 112 sites collected across the nation (USFWS, 1990). From 1985 to 1992, the USFWS monitored pesticides in whole fish from many of its refuges across the nation. This monitoring found concentrations of DDT up to 13 mg/kg in some species and led to the closure of fishing in the Yazoo National Wildlife Refuge (USFWS, 1992, 1992a, 1993). In 1995 and 1996, the U.S. Geological Survey (USGS) sampled several sites in Mississippi as part of the Mississippi Embayment of their National Water Quality Assessment (NAWQA) Program. In this study, DDT and Toxaphene levels from whole carp in the Mississippi Delta streams were consistently the highest of the 230 sites sampled nationwide (USGS 1997).

MDEQ shifted the focus to fish muscle tissue in the 1990s to better assess human health impacts. DDT and toxaphene levels remain a concern in the Mississippi Delta; however, data indicate a significant decline in levels. According to the USFWS data from the Yazoo River at Redwood, DDT levels in whole carp dropped from 5.6 mg/kg in 1984 to 2.2 mg/kg in 1996. Toxaphene levels in these fish dropped from 4.8 mg/kg to 1.6 mg/kg over the same period. Comparing MDWFP data from the late 1960s and 1970s with MDEQ data from the 1990s indicates average DDT concentrations in largemouth bass fillets have dropped approximately 10 fold from 1969 to the present (MDEQ, 2001).

MDEQ's Delta Fish study collected 124 composite samples comprised of 433 fish (MDEQ, 2001). When the results were compared to the Mississippi Fish Advisory Criteria for DDT and Toxaphene several observations were made. All largemouth bass, bream, crappie, freshwater drum and all catfish less than 3 pounds were below the criteria at all sites. 66% of all samples were below the criteria for DDT. Additionally, 73% of all samples were below the criteria for Toxaphene. However, all ten sites had at least two samples that exceeded Mississippi's limit consumption criteria for DDT or Toxaphene. 7 of 9 Cassidy Bayou samples exceeded the criteria, and 7 of 13 Roebuck Lake samples exceeded the criteria, including 3 samples that were above the no consumption criteria. Unfortunately, some form of advisory was warranted at each site sampled. Generally, the tissue concentrations in the lakes and bayous were higher than the concentrations found

in the Sunflower and Yazoo Rivers. Highest concentrations were found in gar, buffalo, carp and the larger catfish (MDEQ, 2001). See Table 2 for the advisory criteria for DDT and Toxaphene.

Table 2. Mississippi Fish Advisory Criteria for DDT and Toxaphene

Consumption	Fish Tissue Concentration (mg/kg) DDT	Fish Tissue Concentration (mg/kg) Toxaphene
No Limit	<1.0	<0.4
2 meals/month	1.0 – 5.9	0.4 – 1.9
No Consumption	>6.0	>2.0

Advisories

The data from MDEQ's Delta Fish study as well as data from MDEQ's ambient monitoring program led the Fish Advisory Task Force to recommend a consumption advisory for the Mississippi Delta. Instead of issuing a patchwork map showing the 10 sites, the task force issued a regional advisory.

On June 26, 2001, MDEQ issued an advisory for the Delta Region of the Yazoo River Basin. This advisory recommends that people limit consumption of carp, buffalo, gar, and large catfish (catfish greater than 22 inches in length) no more than two meals per month. This advisory applies to the entire Delta from Memphis to Vicksburg from the Mississippi River Levee on the west to the bluff hills on the East. This includes all natural waters including lakes, rivers, bayous, and sloughs.

In addition, for Roebuck Lake only, the advisory recommends that people do not eat buffalo from this lake. In August 2001, MDWFP issued a commercial fishing ban for Roebuck Lake.

The advisory does not apply to natural, river-connected, oxbow lakes. Additionally, the advisory does not apply to bass, bream, crappie, freshwater drum, and smaller catfish, nor does it apply to farm raised catfish (MDEQ, 2001).

Priority Ranking

Prioritization of these TMDLs is based on compliance with the federal consent decree. The consent decree calls for all of the TMDLs for water bodies listed as evaluated on the Mississippi 1996 Section 303(d) list in the Yazoo River Basin to be developed by MDEQ before December 31, 2007. EPA Region 4 has an additional six months to complete TMDLs that MDEQ does not complete during this year. Due to the tremendous number of TMDLs required in the Yazoo River Basin, MDEQ is starting early on this task.

Water Quality Standards and Numeric Target

Typically, MDEQ selects a target for TMDL development that corresponds to the standard for the pollutant. In this case, the target for DDT and Toxaphene are based on water column concentrations Table 3. The data, however, that show impairment are gathered from fish flesh samples. Therefore, while the target for the DDT TMDL is the human health water and organism concentrations and the target for the Toxaphene TMDL is the fresh water chronic concentration, both the most conservative criterion available shown in Table 3, the intermediate goal is no fish samples above the Fish Advisory Task Force limit shown in Table 2. While it is understood that it will take many years for these pollutants to dissipate, fish flesh monitoring does indicate a declining trend. Therefore, the intermediate goal for this TMDL is the eventual elimination of fish consumption advisories for DDT and Toxaphene. The TMDL target will be water column concentrations below the standard for the pollutants.

Table 3. Numeric Criteria for All Waters

Parameter	Fresh Water Acute	Fresh Water Chronic	Human Health Organisms	Human Health Water and Organisms
4,4 DDT	1.1 µg/l	0.001 µg/l	0.00059 µg/l	0.00059 µg/l
Toxaphene	0.73 µg/l	0.0002 µg/l	0.00075 µg/l	0.00073 µg/l

To gauge the declining trend, the Mississippi Fish Advisory Task Force selected the levels shown in Table 2 for issuance of fish consumption advisories. It is important to note these levels and that continued monitoring is needed to track future declining trends for these pollutants.

Load Allocation (LA)

DDT and Toxaphene are prohibited from use currently and have been since 1973 and 1983 respectively. Declining trends shown in monitoring fish flesh indicate that the environment is heading toward recovery. The intermediate goal in this TMDL is to reduce levels to such a point that current fish consumption advisories can be eliminated. The current levels indicated by fish tissue monitoring should be reduced below the action level for the consumption advisory. The TMDL target is commensurate with the human health water and organism standard for DDT of 0.59 ng/l, and the fresh water chronic standard for Toxaphene of 0.2 ng/l, shown in Table 3. Once the fish flesh target is met and no further consumption advisories are needed, the load allocation can be determined by multiplying any flow by the concentration standard. This is shown as:

$$LA = Q * \text{standard} * \text{conversion factor}$$

Wasteload Allocation (WLA)

The WLA for this TMDL is zero. There are no known permitted sources for DDT or Toxaphene in Mississippi.

Margin of Safety (MOS)

The MOS is implicit because the TMDL does not allow for loading from point sources. The complete elimination of the fish advisories based on declining levels of the pollutant found in the fish flesh is the goal of the TMDL.

TMDL Calculation

The TMDL is calculated with the following:

$$TMDL = WLA + LA + MOS$$

where WLA = 0 and MOS is implicit. Therefore, the TMDL equals the LA, which is determined by the flow multiplied by the standard and a conversion factor.

Seasonal Variation

The target of no pollutant concentration above the fish advisory consumption level is a year-round goal. Since the WLA and LA apply at all times, the TMDL provides for year-round protection of water quality standards for pesticides. Therefore, the TMDL adequately accounts for seasonal variability.

Reasonable Assurances

This component of TMDL development does not apply to this TMDL. There are no WLA requests depending on LA components and reductions.

Critical Condition

The TMDL represents all flows at all times, and is based on levels of the pollutants found in monitoring fish flesh. The nature of DDT and Toxaphene causes them to have year-round impacts in the fish flesh. Since the WLA and LA apply at all times, the TMDL provides for year-round protection of the water quality standard for these pesticides, including periods when critical conditions occur.

Public Participation

The public has participated in the fish consumption advisory issued for the Delta. MDEQ sent copies of the advisory to the public libraries, bait shops, churches, and social clubs in the Delta. Signs have been posted at each public boat ramp in the region, and a brochure

is included in each fishing license issued by the MDWFP. MDEQ held several public meetings to discuss the advisory, and participated in television call in shows to make the public aware of the advisory.

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the statewide newspaper and newspapers in the area of the watersheds. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. TMDL mailing list members may request to receive the TMDL reports through either, email or the postal service. Anyone wishing to be included on the TMDL mailing list should contact Greg Jackson at (601) 961-5098 or Greg_Jackson@deq.state.ms.us. At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public meeting.

All written comments received during the public notice period and at any public meeting become a part of the record of this TMDL. All comments will be considered in the ultimate completion of this TMDL for submission of this TMDL to EPA Region 4 for final approval.

Technical Analysis

Elimination of DDT and Toxaphene in the environment is a worthy goal for this TMDL Report. By proposing this TMDL, MDEQ makes these watersheds eligible for additional Section 319 nonpoint source pollution funding. The Section 319 Grant, which addresses nonpoint source pollution, was increased in 2001. MDEQ made the decision to use these additional funds on nonpoint source projects that directly deal with TMDL issues. Ongoing agricultural efforts such as CRP, WRP, and EQUIP also support improved water quality through installation of best management practices. The 2002 Farm Bill has an increase in conservation practices also aimed at improving water quality. Therefore it is hoped that the use of best management practices in these watersheds will be accelerated.

Prior to receiving these funds, watershed plans need to be produced and prioritized by the Yazoo River Basin Team. It is also important to include local input on each of these pollutant problems through the Basin Teams.

It is not the task of the TMDL to create new best management practices or to implement any actions. However, it is important to note that BMPs installed in these watersheds that keep the sediment on the fields and out of the stream will also keep DDT and Toxaphene out of the streams and ultimately reduce the levels available for the fish flesh. The result of implementing these BMPs will achieve dual improvements for the watershed that is sediment reduction and pesticide reduction.

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